MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EEL1166 – CIRCUIT THEORY

(All Sections / Groups)

14 OCTOBER 2017
02:30 p.m. - 04:30 p.m.
(2 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **6** pages including cover page and appendix with **4** Questions only.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the answer Booklet provided.

QUESTION 1

(a) A bilateral network is shown in Figure Q1(a). Assume that the current flowing through the 25 Ω resistor is 4 A. Find the value of V_x by using T to π network.

[10 marks]

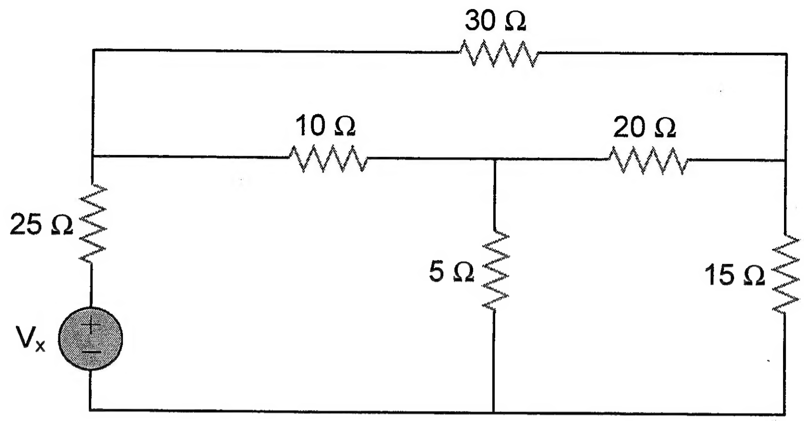

Figure Q1(a)

(b) Find the power absorbed in the 8 Ω resistor in Figure Q1(b) using superposition theorem.

[15 marks]

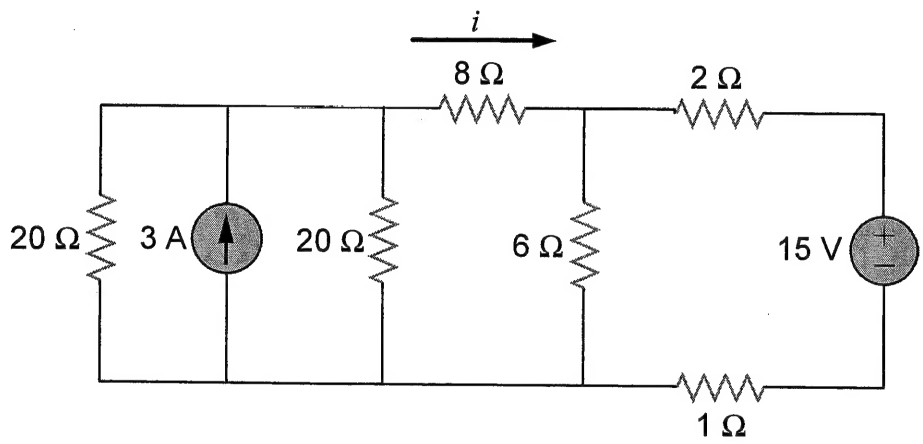

Figure Q1(b)

Continued ...

QUESTION 2

(a) For the circuit shown in Figure Q2(a).

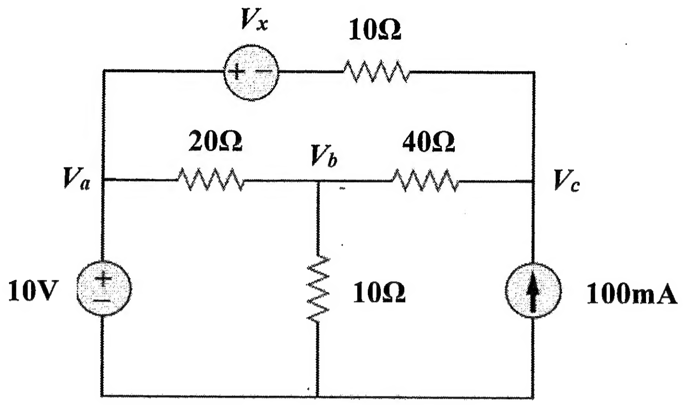

Figure Q2(a)

(i) State the essential nodes of the circuit. [3 marks]

(ii) Convert the unknown voltage source, V_x branch to current source. [3 marks]

(iii) Based on part 2(a)(ii), calculate the node voltages, V_a, V_b and V_c using nodal analysis if $V_x = 2\text{V}$. [8 marks]

(b) Consider the periodic signal, Y defined by the equations:

$$Y(t) = \begin{cases} t, & 0 < t \le 2 \\ 4 - t, & 2 < t \le 6 \\ -8 + t, & 6 < t \le 8 \end{cases} \text{ and } Y(t) = Y(t-8)$$

(i) Explain why $Y(t)$ is a periodic, but not an aperiodic signal. [2 marks]

(ii) Draw the signal waveform and label clearly the x-axis and y-axis. [3 marks]

(iii) Find the period, rms value and crest factor of Y. [6 marks]

Continued ...

QUESTION 3

(a) Apply phasor analysis to evaluate what of v(t):
$v(t) = 110\cos(20t + 30^o) - 220\cos(20t + 45^o)\text{V}$

[7 marks]

(b) In the circuit of Figure Q3 (b), determine the phasor of $i_s(t)$. Calculate the average power delivered by the voltage source $v_s(t)$.

[12 marks]

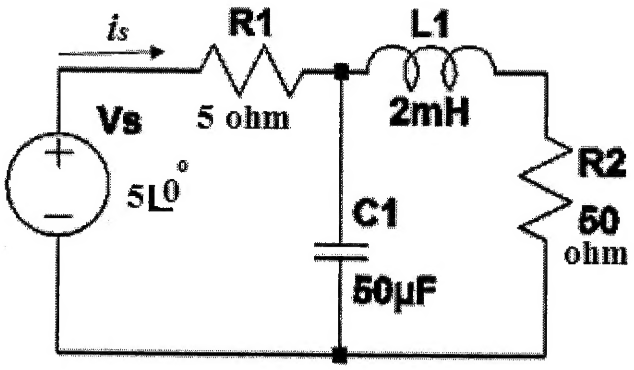

Figure Q3 (b)

(c) A parallel RLC circuit has resonance at f_o = 400 Hz, has a Q factor of 50 at f_o, and a resistive branch of 100Ω. Determine the values of L and C in the other two branches.

[6 marks]

Continued ...

QUESTION 4

(a) A parallel LR circuit is shown in Figure Q4(a). Given that R_S =8Ω, R_1= 24Ω, R_2=8Ω and L=7H, determine the inductance current (i_L) for time t>0 and t<0.

[10 marks]

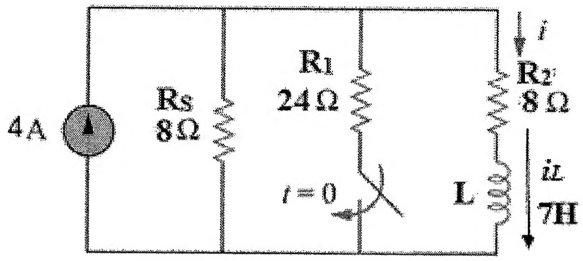

Figure Q4(a)

(b) A series RLC circuit has R=100Ω and C=3 mF. Determine the value of L that will make the RLC circuit.

(i) critically damped

[5 marks]

(ii) over damped

[2 marks]

(c) Design a source free parallel RLC circuit that has the characteristic equation of $s^2+600s+10^6=0$, assuming R=22kΩ.

[8 marks]

End of Paper

Appendix

Parameter	Series RLC network	Parallel RLC network
Input impedance Z_{in}	$R_s + j\omega L_s + \dfrac{1}{j\omega C_s}$	$\left(\dfrac{1}{R_P} + \dfrac{1}{j\omega L_P} + j\omega C_P\right)^{-1}$
Resonance frequency	$\omega_o = \dfrac{1}{\sqrt{L_s C_s}}$	$\omega_o = \dfrac{1}{\sqrt{L_p C_p}}$
Quality factor, Q at resonance frequency	$Q_s = \dfrac{\omega_o L_s}{R_s} = \dfrac{1}{\omega_o R_s C_s}$	$Q_P = \dfrac{R_P}{\omega_o L_p} = \omega_o R_P C_p$
Bandwidth BW (note that this is just an approximation)	$\dfrac{\omega_o}{Q_s}$	$\dfrac{\omega_o}{Q_p}$